RESEARCH REPORT

Promoting walking to school: results of a quasi-experimental trial

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J Epidemiol Community Health 2007;**61**:818–823. doi: 10.1136/jech.2006.048181

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Accepted 3 August 2006

Study objective: To assess the impact of a combined intervention on children's travel behaviour, stage of behavioural change and motivations for and barriers to actively commuting to school.
Design: A quasi-experimental trial involving pre- and post-intervention mapping of routes to school by active and inactive mode of travel and surveys of ''stage of behaviour change'' and motivations for and barriers to actively commuting to school.
Intervention: The intervention school participated in a school-based active travel project for one school term. Active travel was integrated into the curriculum and participants used interactive travel-planning resources at home. The control school participated in before and after measurements but did not receive the intervention.
Setting: Two primary schools in Scotland with similar socioeconomic and demographic profiles.
Participants: Two classes of primary 5 children and their families and teachers.
Main results: Post intervention, the mean distance travelled to school by walking by intervention children increased significantly from baseline, from 198 to 772 m (389% increase). In the control group mean distance walked increased from 242 to 285 m (17% increase). The difference between the schools was significant ($t(38) = -4.679$, $p<0.001$ (95% confidence interval −315 to −795 m)). Post intervention, the mean distance travelled to school by car by intervention children reduced significantly from baseline, from 2018 to 933 m (57.5% reduction). The mean distance travelled to school by car by control children increased from baseline, from 933 to 947 m (1.5% increase). The difference in the change between schools was significant ($t(32) = 4.282$, $p<0.001$ (95% confidence interval 445 to 1255 m)).
Conclusions: Intervention was effective in achieving an increase in the mean distance travelled by active mode and a reduction in the mean distance travelled by inactive mode on school journey.

Promoting increased levels of physical activity in the general population has been described as ''an important element of any future public health strategy''.[1] Physical activity is associated with positive effects on many health outcomes in childhood and adolescence, including benefits to skeletal health and several aspects of psychological health. Regular moderate physical activity in childhood can also help in the prevention and treatment of obesity, a growing public health concern in Western societies today.[2]

Physical activity guidelines for children and young people recommend that all young people should participate in physical activity of at least moderate intensity for 1 h per day.[3] The Scottish Health Survey of 2003 found that one in three girls and one in four boys do not achieve this level.[4] National transport studies have also shown that, over time, fewer children are walking or cycling to school, and at the same time there has been a marked increase in the use of cars to chauffeur children to school. The Scottish Household Survey of 2004 found that in 1999 walking was the usual method of travel to school for 54.7% of pupils in full-time education, whereas in 2004 this had decreased to 51.1%. During the same period, the percentage of pupils whose usual method of travel to school was by car or van increased from 18.3% to 21.7%.[5] Furthermore, there is evidence that children are becoming accustomed to being driven short distances and that car dependency is being established at an early age.[6]

Influencing school travel behaviour towards active mode of travel would benefit pupils' health through promoting physical activity during the journey to school and the environment through reducing car use. The Royal Commission on Environmental Pollution has described traffic growth as ''possibly the greatest environmental threat facing the UK''.[7]

A number of studies have shown that walking to school is associated with higher overall physical activity levels.[8–11] Initiatives aimed at promoting active commuting as an alternative to using cars are becoming more prevalent in the UK; however, there is little evidence of the effectiveness of interventions.[12] Government policy currently provides funding for school travel co-ordinators within local authorities to develop more sustainable approaches to school travel in partnership with schools and communities, a main feature of which is to develop school travel plans; however, the effectiveness of this intervention has not been established.[13 14]

Little is known about what interventions are indeed effective in tackling the ''school run'', promoting a modal shift and supporting children to walk or cycle to school instead of travelling the entire way by car. We aimed to assess the impact of an intervention designed to tackle the school run through a quasi-experimental trial with primary school children aged 9 years old and their families.

METHODS

Selection of schools

Two primary schools in West Dunbartonshire, Scotland, were selected to take part in the study. The schools had a similar demographic profile[15] and were located in two villages roughly 3 miles (5 km) apart. An interagency project team invited expressions of interest from schools in the local area and established criteria for selecting the schools based on their level of commitment to become involved in the study. Schools were

advised that they would each be given the opportunity to receive the intervention. The study design required a control school and an intervention school. One head teacher expressed a preference for her school to receive the intervention first whereas the other head teacher expressed no preference and so the latter school was selected to receive the intervention later, thus acting as the control school.

Sampling participants

Pupils who lived within the statutory walking distance[16] and who were currently driven to school were identified by the project team as a potential target group for the intervention. In Scotland free transport is available for children whose nearest suitable school is further from their home than the statutory walking distance, defined as 2 miles (3.2 km) for pupils under 8 years old and 3 miles (4.8 km) for those aged 8 and above.

Road safety initiatives were already integrated into the curriculum at two stages in the study schools: at primary 1 (pupils aged 5 years old) and primary 6 (pupils aged 10 years). The project team, in consultation with school management and parents/guardians, considered that the involvement of primary 5 pupils (aged 9 years) would complement the road safety input delivered in primary 6. Children in upper primary (from primary 5 to primary 7) are likely to have greater independence and maturity to walk to school than pupils in lower primary school (from primary 1 to primary 4). For these reasons, one class of primary 5 pupils was chosen to be the study population. The statutory walking distance that applies to the study population is 3 miles (4.8 km). Pupils who lived within this distance and were driven to school were the main target group for the intervention.

Baseline data collection

A computerised mapping programme was used to record school travel behaviour at baseline and follow-up.[17] Children were asked about their usual method of travel to school and were assisted to use the mapping programme to record the following information:

- a map of their route to school;
- the distance travelled from their home to school;
- the mode(s) of travel used for their journey to school;
- the distance travelled by mode(s).

This mapping exercise was used capture the variability of travel behaviour for the journey to school. We found that children in this study used more than one mode of travel to get to school, e.g. driven all of the way to school or driven some of the way to school, with the rest of the journey completed on foot. The mapping information was used to measure and compare the differences in school travel behaviour between baseline and follow-up for each school and differences between schools.

An online computerised questionnaire that was successfully used with older children was adapted and used in this study to ascertain ''stage of behaviour change'' and the benefits of, motivations for and barriers to making an active journey to school.[18] The questionnaire information was used to calculate total scores, range and ranking of frequency for benefits, motivations and barriers.

The intervention school participated in the intervention during the school spring term.

Follow-up mapping activity and questionnaires, repeating the same outcome measures collected at baseline, were collected 10 weeks from baseline. The control school participated in the before and after measurements, but it did not receive any components of the intervention at that time.

Intervention

The intervention involved participation in Travelling Green, a school-based active travel project. The intervention period was one school term (10 weeks). The Travelling Green project was delivered in the intervention school during term 3, between the Easter and summer breaks. The classroom teacher and the school children and their families used a set of written interactive resources during the Travelling Green project. The interactive resources were of two types, as follows:

- *Curriculum materials*. The curricular component of the intervention was a curricular resource guide for teachers aimed at 5- to 14-year-olds to support the delivery of school travel projects within the curriculum. The resource pack was designed by the sustainable transport organisation Sustrans and adapted for schools in Scotland to reflect the linkages with the 5- to 14-year-old curricular guidelines for Scottish Schools.[19] This resource was designed to support teachers to deliver active travel projects through the existing curricular guidelines and across a variety of topic areas. It offered ideas for making an active travel project informative, interactive and appropriate for primary school children. The class teacher was encouraged to use this resource to help integrate the Travelling Green project into the curriculum during the intervention phase of the study.
- *Children and family resources*. The Travelling Green pack contained a set of active travel resources designed to be used by children and their families at home to engage them in the project outside the formal curriculum. The pack was pre-tested with a similar target audience. There were 11 components parts, including various resources designed to enable children and their families to participate in the project. The primary aim of the pack was to provide practical guidance about how to plan an active journey to school.

The pack contained a number of interactive tools, some of which were tailored to the participating school. A customised map of the school community illustrated the core path networks linking the wider community to the school. It highlighted the main pedestrian crossing points on the network and illustrated familiar landmarks within the community. A distance and time chart provided information about journey times on foot. The pack also contained weekly goal-setting activities to help children and their families get ready to walk and set goals for changing their travel to school behaviour. Other aspects of the pack were not specific to the participating school but provided generic information about walking to school. These included an activity diary in the form of two wall charts for recording the journey to and from school, practical advice about being a safe pedestrian and looking after personal safety, useful contacts and reflective safety accessories. The pack is available from the corresponding author on request.

Ethics approval

Parental consent for children's involvement was obtained, as was the full support of the education authority, school management and teaching staff. A parents' information evening was held for those participating in the Travelling Green project. The ethics committee of the University of Strathclyde approved the project.

Statistical analysis

The statistical analysis and data management system SPSS was used to generate the results in this section.[20] t-Tests were used to analyse continuous data. Chi-square tests were used to test the significance of cross-tabular relationships.

Results

Baseline journey measurements and travel questionnaires were collected from 60 participants, which represented a 100% response rate (intervention group, n = 31; control group, n = 29). The mean age of participants was 9 years (range 9–10 years), 40% boys (n = 24) and 60% girls (n = 36). Baseline journey measurements included the distances travelled from home to school, the distance travelled to school by walking and the distance travelled to school by car. Table 1 shows the mean baseline measurements for the control and intervention school and the mean differences in these measurements between schools.

Table 1 shows that at baseline the intervention and control schools were not similar – there was a significant difference in the mean distance travelled from home to school between the intervention and control school, with children in the intervention school travelling a greater distance to school. There was also a significant difference between the schools in the mean distance travelled to school by car, with children in the intervention school travelling a greater distance to school by car. However, the mean distance travelled to school by walking was low for both schools (198 and 242 m/day for intervention school and control school respectively) and no significant difference existed between schools.

Impact on walking

Fifty-five follow-up journey measurements and travel questionnaires were collected, which represented a response rate of 92% (intervention group, n = 29; control group, n = 26). Table 2 presents the follow-up journey measurements for the control and intervention school, the mean differences in the distance travelled to school by walking and by car between baseline and follow-up for each school and the mean differences in these measurements between schools.

Table 2 shows that at follow-up the mean distance travelled to school by walking by intervention school children had significantly increased from 198 to 772 m, which represents a 389% increase. This increase was not observed for the control school as the mean distance travelled to school by walking increased from 242 m at baseline to 285 m at follow-up, an increase of just 17%.

Impact on car use

Table 2 shows that at follow-up the mean distance travelled to school by car by intervention school children had significantly reduced from 2018 m to 933 m, which represents a 57.5% reduction. This reduction was not observed for the control school as the mean distance travelled to school by car actually increased from 933 m at baseline to 947 m at follow-up, an increase of 1.5%.

Twenty-three intervention school children positively changed their behaviour from baseline to follow-up by increasing the distance travelled to school by active mode (walking) and decreasing the distance travelled to school by inactive mode (car). Five children who at baseline made at least part of their journey to school by car made no behaviour change as a result of the intervention. One child increased the distance travelled to school by inactive mode (car) from baseline to follow-up. Figure 1 shows a map of the intervention school community with each child's route to school at baseline and figure 2 shows the same map at follow-up. Routes to school made by car are shown in red and routes by walking are shown in green. The thickness of the red and green lines represents the number of journeys made by that mode. In Figure 1 it is evident that the red line dominates, corresponding to a large number of cars being used for the school run at baseline, whereas in figure 2, at follow-up, the green line becomes more evident, corresponding to the increase in the distance travelled to school by walking and the reduction in the distance travelled by car. The follow-up journey measurements reveal that children from the intervention school appeared to be travelling part of the way to school by car and part of the way on foot.

Stage of behaviour change for active commuting

Seventy-one per cent (n = 20) of the intervention group progressed to a higher ''stage of change'' of behaviour change relating to active commuting or remained in the ''action''' and maintenance'' stages compared with 52% (n = 14) of the control group in relation to making an active journey to school. Prochaska and Marcus[20] suggest that movement towards the ''action'' and ''maintenance'' stages of change reflects progression with regards to an individuals' readiness to adopt a healthy behaviour. The results of this study suggest that a greater proportion of intervention school children had progressed in relation to their readiness to adopt an active journey to school.

Benefits, motivation and barriers for making an active journey to school

The mean number of barriers given by children whose main mode of travel to school at baseline was by car was similar between groups (intervention group mean, 2.90 (SD 1.651); control group mean, 3.13 (SD 1.405)). ''An adult drives me all the way'' was the most common barrier given by both groups, with 65% (13 out of 20) of intervention and 54% (7 out of 13) and control children citing this reason.

All children were asked about the benefits of actively commuting to school. The mean number of benefits given at baseline was similar between groups (intervention group mean, 5.58 (SD 0.42); control mean, 4.34 (SD 0.376)). ''Being able to walk and talk to friends on the way to school'', ''getting lots of fresh air'' and ''becoming healthier'' were regarded by both groups as the top three benefits associated with actively commuting to school.

Table 1 Baseline journey measurements for the intervention and control schools

Measurement	Intervention school	Control school	Mean difference between the intervention and control school
Mean distance travelled from home to school (m)	2215 (SD 1159)	1174 (SD 1098)	1041, t (58) = −3.567, p<0.001 (95% CI −458 to −1624)
Mean distance travelled to school by walking (m)	198 (SD 338)	242 (SD 267)	44, t (58) = 0.558, p = 0.579 (95% CI −114 to 202)
Mean distance travelled to school by car (m)	2018 (SD 1302)	933 (SD 1195)	1085, t (58) = −3.356, p<0.001 (95% CI −440 to −1731)

CI, confidence level.

Table 2 Journey measurements for the intervention and control school: comparison between baseline and follow-up

Measurement	Intervention school	Control school	Mean difference between intervention and control schools
Mean difference in the distance travelled to school by walking between baseline and follow-up (m)	602 (SD 586) (389% increase)	47 (SD 242) (17% increase)	555, t (38) = −4.679, p<0.001 (95% CI −315 to −795)
Mean difference in the distance travelled to school by car between baseline and follow-up (m)	−900 SD 1033 (57.5% reduction)	50 SD 262 (1.5% increase)	850.5, t (32) = 4.282, p<0.001 (95% CI 445 to 1255)

CI, confidence level.

The mean number of motivations given by children whose main mode of travel to school was by car at baseline was similar between groups (intervention group mean, 3.40 (SD 2.06); control group mean, 2.06). ''If I was driven some of the way and dropped off within walking distance'' and ''Cars kept away from the school entrance'' was the top response given by intervention and control children respectively in response to being asked ''what would motivate you to actively commute to school?''.

Discussion

The intervention was effective in increasing the distance travelled by active mode (walking) and reducing the distance travelled by inactive mode (car) for the journey to school in the intervention group. Research investigating the effectiveness of interventions to achieve an increase in walking and a reduction in car use for the journey to school is limited. Previous studies have concentrated on objective measures of children's physical activity and the contribution of walking to school to daily physical activity. Where research does exist, there is little or no evidence reporting an increase in the mean distance travelled by walking and a reduction in the mean distance travelled by

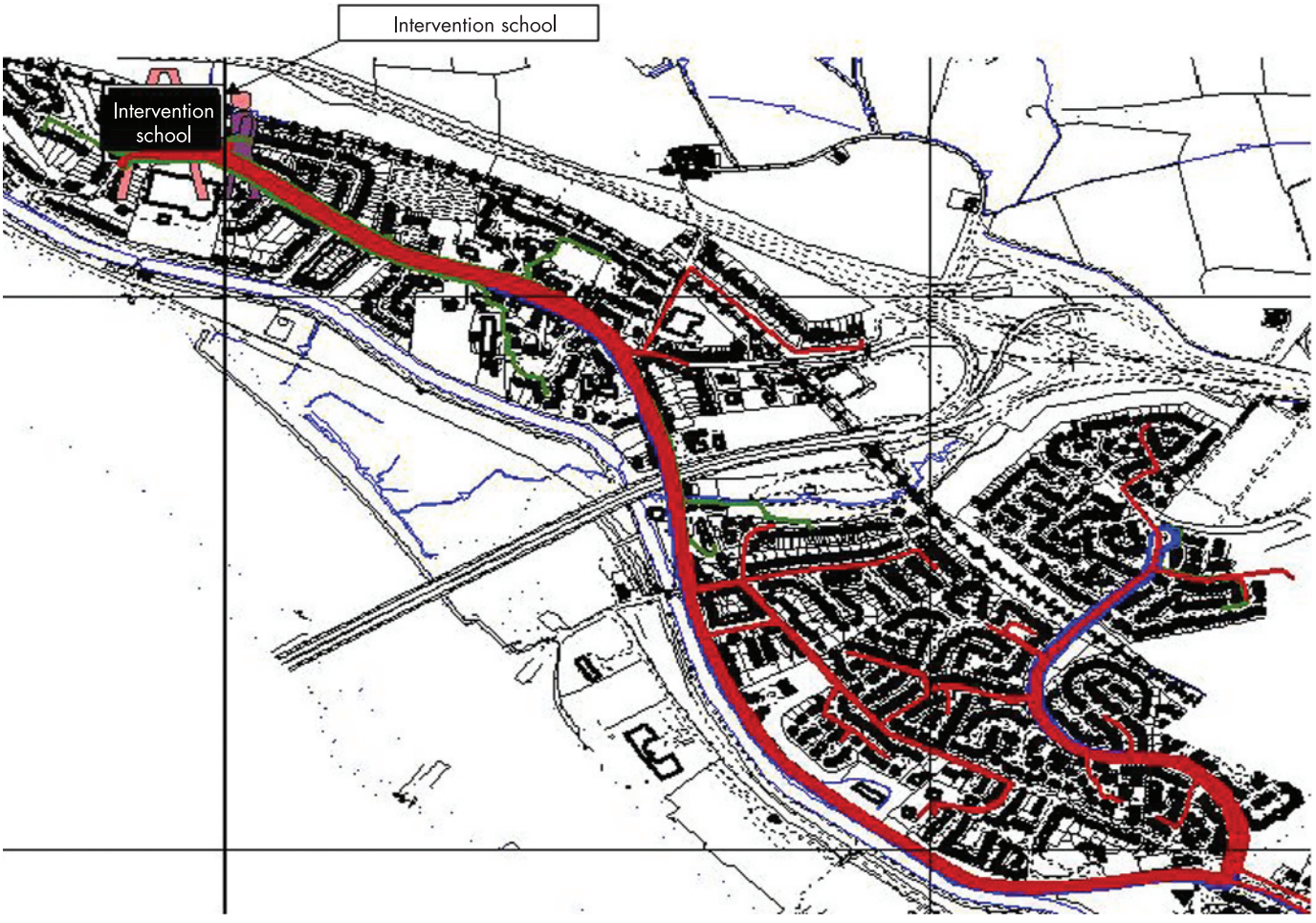

Figure 1 Routes to school by intervention children at baseline.

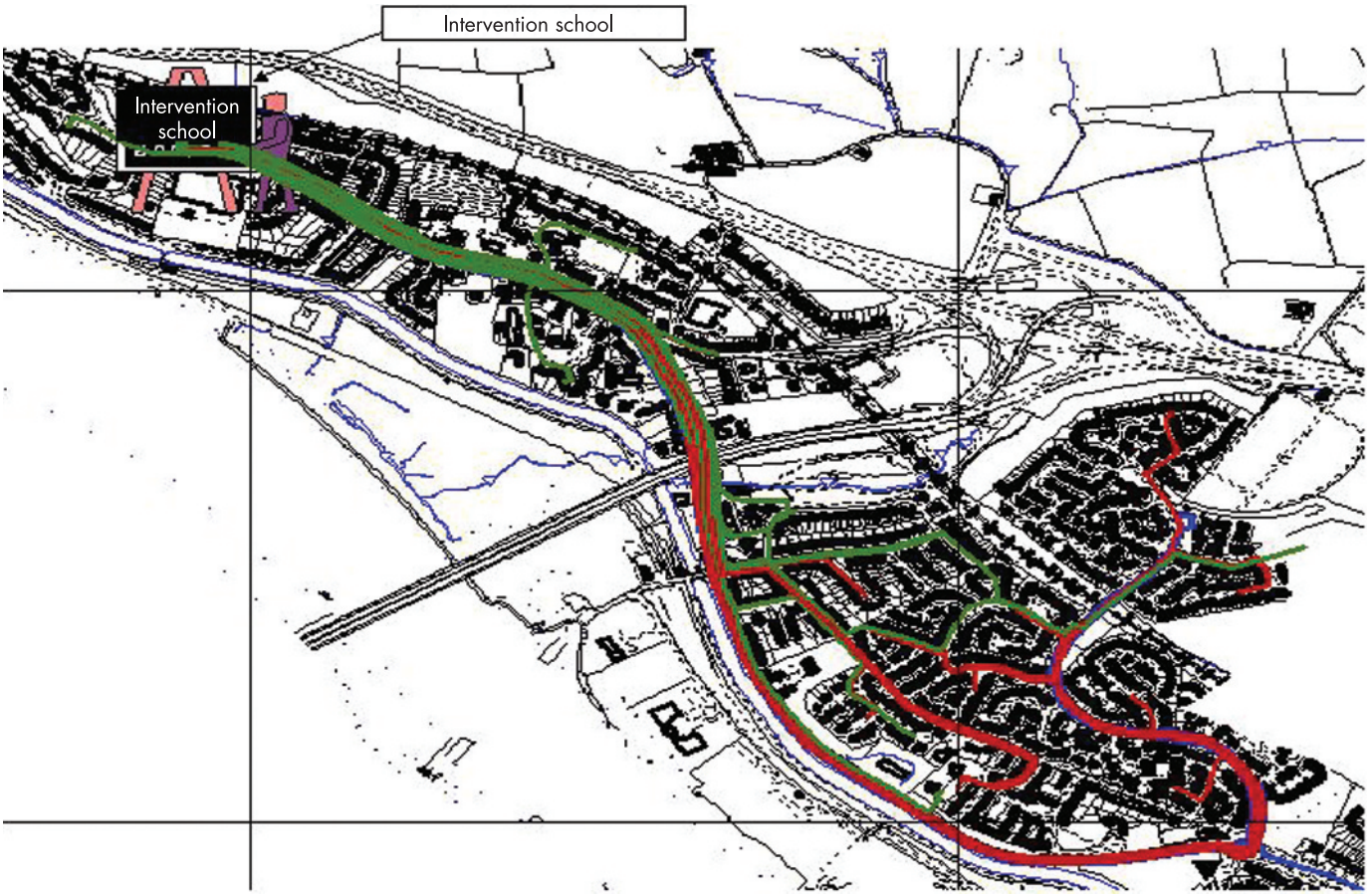

Figure 2 Routes to school by intervention children at follow-up.

car as the main outcomes. Many school travel initiatives have been developed and measures to promote active commuting to school have been implemented without an assessment of their impact against a baseline. This study conducted a number of baseline measurements prior to the intervention, repeated the same measurements following the intervention, and detected a significant increase in the mean distance travelled by active mode (walking) and a significant reduction in the mean distance travelled by inactive mode (car).

This study has shown that the journey to and from school presents an ideal opportunity for children to contribute to the achievement their daily physical activity target. Following the intervention, the mean distance travelled to school by walking was almost 800 m for the intervention school children. This represents 12 min of physical activity at an average speed of 4 km/h. If repeated on the journey home from school, this would correspond to 24 min of physical activity, accounting for almost half the recommended daily physical activity set by the Scottish Physical Activity Strategy.[21]

The Travelling Green pack was a useful active travel-planning tool for school children and their families, and the curriculum materials were well received by the school. Children recognised both social and health benefits of an active journey to school and identified the main barrier to making an active journey to school as adults driving them all the way. The interactive travel questionnaire and computerised mapping activities were particularly valued by the school for their contribution to learning as well as being an accurate source of data collection for the researchers. Travelling Green was an effective way to engage children, families and schools in active travel issues.

Limitations

A quasi-experimental research design was adopted by this study as not all research in which an independent variable is manipulated fits clearly into one of the true experiment designs (such as experimental research). The researchers attempted to fit the design to a real-world setting while still controlling as many threats to internal validity as possible. Random sampling of participants was not possible as they were an ''intact group'' (a class of primary school children) and it was not feasible to randomly assign them to either a control or an intervention group. Furthermore, access to participants had to be negotiated via a series of gatekeepers (parents/guardians, teachers and local education authority). This lack of random assignment may have caused selection bias. Random assignment of intervention and control school status was not practicable as researchers were not in a position to ''impose'' the study on schools without negotiating consent and commitment to participate. Assignment occurred when one school expressed a preference over another school to receive the intervention first. Modest selection bias therefore may have occurred, resulting in non-equivalent groups. Influences other than Travelling Green may have been important in the promotion of walking to the intervention school, given its clear enthusiasm to receive the intervention. Baseline results showed that there was a significant difference in the mean distance travelled from home to school between schools. It could be argued that walking to school was more achievable for control school children since they lived significantly closer to school (mean distance 1.2 km) than intervention children (mean distance 2.2 km). On the other hand, it could be said that intervention school children had greater scope to change their travel behaviour.

Policy implications

School travel co-ordinators and others working with schools and their communities to develop sustainable school travel strategies should consider this research in the development of their plans.

What is already known on this topic

- Physical inactivity in childhood is a serious public health issue and levels of obesity in childhood are rising.
- National health surveillance surveys have shown that children's physical activity levels are a cause for concern. National transport studies have also shown that, over time, fewer children are walking or cycling to school and there has been a notable increase in the use of cars to chauffeur children to school.
- Little is known about effective ways to increase levels of daily physical activity among children.
- Walking to school has been overlooked as a source of daily physical activity for children.

What this study adds

- This study makes an important contribution to the evidence base on effective approaches to promoting physical activity through active travel to school.
- Mapping routes to school provides useful and accurate information that can be used to promote safer and active routes to school and monitor travel behaviour.
- Tailored active travel resources are an effective way to engage children, families and schools about active travel issues.
- Increasing the distance travelled by active mode (walking) and reducing the distance travelled by inactive mode (car) for the school run is achievable.
- Active travel helps children achieve their daily physical activity goal. School travel projects benefit from the support of a multidisciplinary team with representatives from the health, education and transport sectors.

Conclusions

Travelling Green was effective in supporting behaviour change and achieving an increase in the mean distance travelled to school by active mode (walking) and a reduction in the mean distance travelled to school by inactive mode (car). An active travel to school project such as this underpins the core components of the health-promoting school model,[22] i.e. it is integral to the curriculum, school ethos, policies, services, extracurricular activities and partnerships with families and local community. This study makes an important contribution to the evidence base on effective approaches to promoting physical activity through active travel to school and should be adopted as a model of best practice. Future research should focus on how to assist children and their families to maintain active travel behaviour in the longer term.

ACKNOWLEDGEMENTS

We thank the project team of Bob Fleming, Linda McBrearty and Catherine Toner of Housing and Technical Services and Angela Simms of Education and Cultural Services at West Dunbartonshire Council for guiding the conduct of the study and championing Travelling Green. We also thank the schools that volunteered to take part and all the participants for being enthusiastic and responsive. Funding: NHS Greater Glasgow provided funding for the co-ordination of the study and development of the intervention resources.

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